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(54) Artery support insertion instrument

(57) An instrument carries an artery support material section which it then reduces to a suitable diameter so that the whole instrument can be inserted into a patient's artery using a catheter method.

The instrument comprises a bobbin in two halves 1, 2 connected by a spring 5 or pair of magnets; two cables 8, 12 pass through the bobbin and operate two umbrella-type gripping mechanisms 10, 14, one on each side of the bobbin. The artery support material passes over the bobbin and gripping mechanisms and is stretched by separating the bobbin halves so that the material reduces in diameter for insertion into the artery.

Upon reaching the area of the artery that is requiring support the support material is returned to its original diameter, the instrument closed down to a diameter less than the interior of the artery and the instrument is withdrawn.

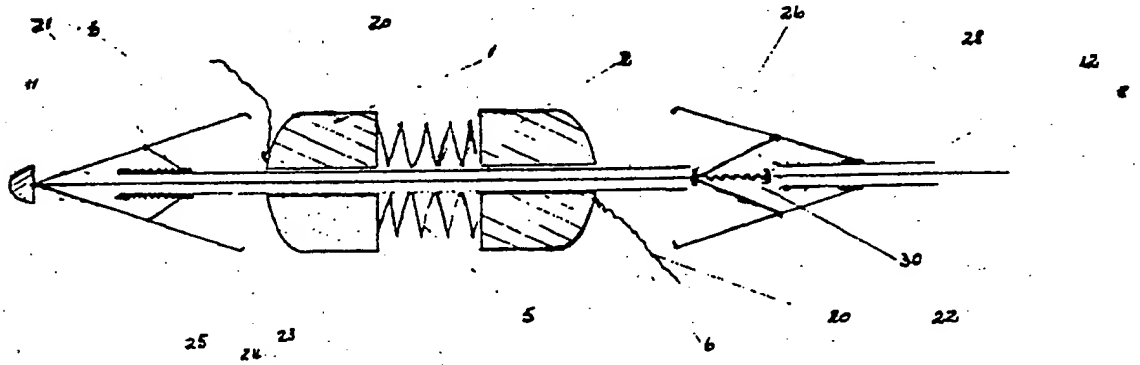

FIGURE 4

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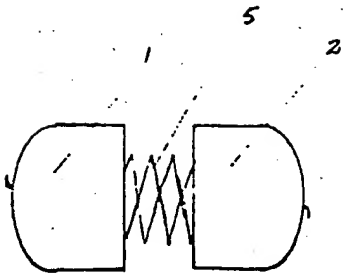

FIGURE 1

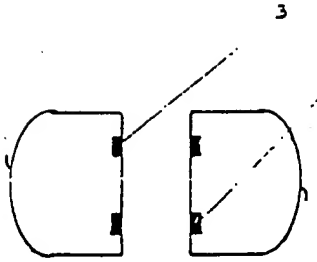

FIGURE 1' (ALTERNATIVE)

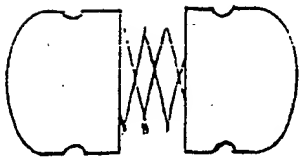

FIGURE 2.

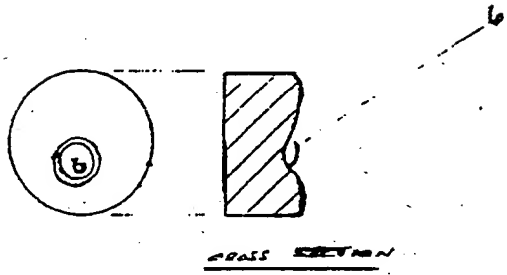

FIGURE 3

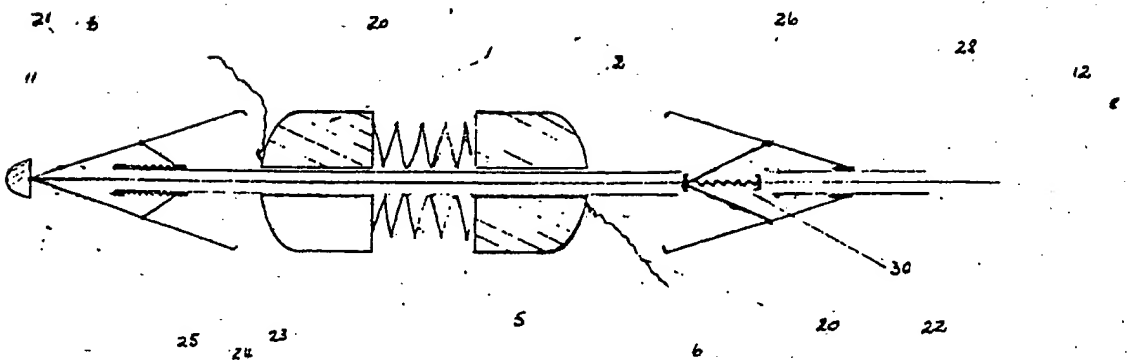

FIGURE 4

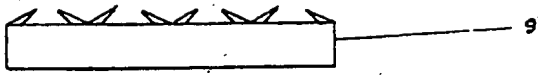

FIGURE 5

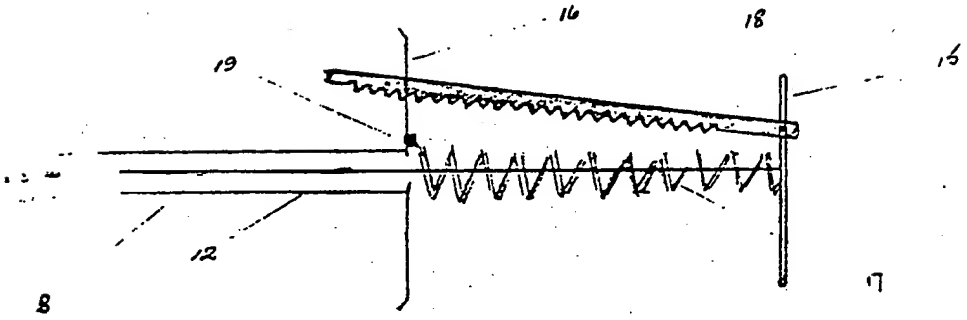

FIGURE 6

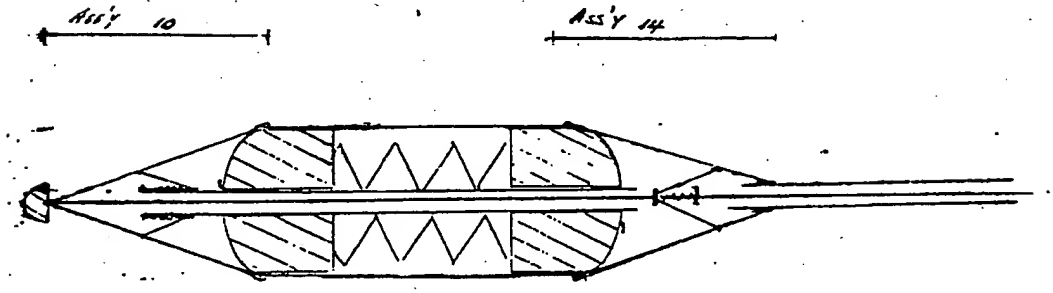

FIGURE 7

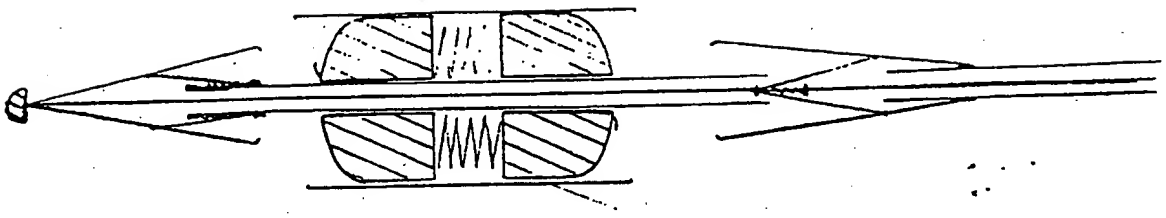

FIGURE 8

ARTERY SUPPORT INSERTION INSTRUMENT.

This invention relates to an instrument to enable the insertion of support(s) of cardiac, and other, artery walls by catheter through the patient's arteries.

Modern heart,and other, surgery involving collapsed arteries employs an operation known as angioplasty. This involves insert--ing a catheter instrument on the end of which is fitted a ball--oon into the cardiac artery. The inflation of the balloon at the affected part of the artery pushes the walls of the artery back to its normal, or near normal, configuration, and therefore diameter, so that normal, or improved, flow of blood occurs. The catheter and deflated balloon are then withdrawn.

Unfortunately, in many cases the new or revived form of the art--ery is not maintained for a variety of reasons, such as weak--ness of the artery wall or muscle at that point. This collapse may take place quite soon after the angioplasty, or after months or even years. A similar situation can arise with other arteries of the body.

According to the present invention there is an instrument which can be inserted into the patient's artery, in the same manner as in angioplasty, which places a suitable support in the correct position to support the affected artery wall(s). To push any sup--port, which was of the required diameter to support the affected artery, through a patient's artery is not possible, because if it

is to be a good fit and support, it must, of necessity, be equal to, or even very slighly larger than,the diameter of the artery to be supported. This would inevitably mean that in its passage through the patient's other arteries great damage would be done. This present invention enables the positioning of the artery sup--port without damage to the patient's arteries by reducing the diameter of the support until it is in position when it then ret--urns the support to the correct diameter, thus both supporting the artery wall and locking itself into position.

The instrument consists of a central plastic, or similar, bobbin in two equal halves, with a light tension spring, or alternative--ly two small permanent magnets inserted one in each half, attrac--ting the two halves together, a pair of concentric cables or wir--es operated at the surgeon's end by two draw-shoulders with a multi-notched locking device, two sets of expanding and contrac--ting fingers or grips operating on the umbrella principle.

A specific embodiment of the invention will now be described by way of example to the accompanying drawing:

Figure 1 shows the bobbin, made of medically-suitable plastic, or other material, in its two halves, 1 & 2. The two halves are connected by a light tension spring,5, which draws the two halves together; or in the alternative each half may inccrpor--ate a small permanent ring magnet, 3 & 4, to perform the same function.

Figure 2 shows an alternative formation of the two bobbin halves, each having a slight recess near to the nose of each half, to assist the grip of the fingers,11, on to the support material,9.

Figure 3 shows the end of one of the bobbin halves showing the hook,6, through which a short length of suture, or similar,20, and knotted at one end, is threaded. Each bobbin half has one of these hooks,6.

Figure 4 shows the head of the instrument, prior to loading with the support material,9, which is to be inserted. Through the bobbin halves,1 & 2, runs a surgically-safe metal or plastic inner cable,8, which itself runs in an outer surgically-safe metal or plastic cable. On the end of the inner cable,8, and at the forward end of the bobbinn is fitted an umbrella mechanism, 10; similarly, at the other end of the bobbin another umbrella mechanism,14, is fixed to the outer cable,12. These umbrella mechanisms,10 & 14, are linked to a plurality of fingers,11. The number of fingers on each can be varied, but three on each appears a very suitable number. The end of each finger shall be formed as an arc of about 45 degrees (in the case of three fin--gers), which arc shall be of the same radius as that of the bobbin surface. Bobbin halves,1 & 2, being drawn together by spring,5, or in the alternative, by magnets,3 & 4; the two draw--shoulders,15 & 16, being pulled, umbrella mechanisms,10 & 14, are actuated, and fingers,11, then close right down to cables, 8 & 12, allowing support,9, to be slipped over the unit and lined up centrally on the closed bobbin halves,1 & 2. The diam--eter of the support,9, is selected to suit the patient's arter--ies, and the bobbin halves,1 & 2, are similarly selected. This support can be made of any medically-approved plastic, or other synthetic material, or can be a human or animal artery section. If a synthetic material is used it can be made as shown in Fig-

-ure 5, where the form of the exterior of the man-made mater-
-ial assists in 'anchoring' the support section,9, in the art-
-ery.

Figure 6 shows the other end of the instrument - i.e. the end operated by the surgeon's hand. Two draw-shoulders,15 & 16, are connected to inner cable,8, and outer cable,12, respectively; and a spring,17, is positioned between the two finger-operated draw-shoulders,15 & 16. When the required'stretch' of the supp-
-ort material,9, has been achieved, this position of the two draw-shoulders,15 & 16, and the respective cables,8 & 12, is held by means of the multi-notched plate,18, being engaged on pin,19.

Figure 7 shows the instrument now loaded and ready to insert into the patient's arteries. The 'loading' is carried out as follows: An assistant pulls on the two suture lengths,20, which are each knotted at one end only and have been threaded through hooks,6, until the two bobbin halves,1 & 2, are in their correct positions, with the ends of the support material,9, lining up with the ends of the bobbin halves. The surgeon then operates the two sets of umbrella mechanisms,10 & 14, by using the draw-shoulders,15 & 16, so that the fingers,11, now grip on to the end of the support material,9, squeezing it down on to the two bobbin halves,1 & 2. The surgeon then continues to operate the pull mechanism, thus further separating the two bobbin halves, 1 & 2, and at the same time stretching the support material,9. This separation of the two bobbin halves,1 & 2, with the support material,9, gripped on to them by the fingers,11, is acchieved as follows: When the fingers,11, have closed and fully gripped the

support material,9, on to the two bobbin halves,1 & 2, they can close down no further, and continued operation of the pull mech--anism now pushes inner cable,8, further out, whilst at the same time drawing the outer cable,12, further back, and the fingers,11 being held hard down on to the bobbin halves,1 & 2, the bobbin halves then separate more and more. This separation would be im--possible if the arms, 21 & 22, were rigidly attached at their two ends, but it will be seen from Figures 4, 7 & 8, that the end of each arm,21 of umbrella 10, at the front end is rigidly att--ached to finger 11 at one end, but at the other end it is att--ached to a ring,23, which encircles the outer cable,12, and this is free to move forward along the outside of outer cable 12, ag--ainst a compression spring,24, which is compressed between this ring,23, and a solid ring,25, fixed to the end of this outer cable 12. In a somewhat similar manner, on umbrella 14 at the rear end, there are similar arms,22, which in this case are attached pivot--ally to the fingers,11, at one end, but at the other end they are attached to another small ring,26, which in this case encir--cles the inner cable,8, and is free to move backwards along this inner cable,8, against another compression spring,27, which is trapped between the ring,26, and a small solid ring,28,fastened to the inner cable,8. The arms,22, run through slots,30, cut in the outer cable,12, to allow this movement backwards of the arms, 22. The total amount of 'stretch' of support material 9, that may may be required can be accomodated by ensuring that the distan--ces between the fixed and free-running rings, 23 & 25 and 26 & 28, are suitable; and in the case of the rear end only, also that the slots,30, in outer cable,12, are long enough to accomodate the movement of arms,22. When the surgeon is satisfied that the

diameter of the support material,9, is that desired, he then locks the draw-shoulders,15 & 16, in that position, by engag--ing pin,19, in the appropriate slot in the multi-notched plate, 18. At the same time the two lengths of suture,20, are completely withdrawn and discarded. The whole instrument can now be inser--ted into the arteries of the patient in the same manner as with an angioplast catheter.

Figure 8 shows the support,9, now in position, and the instrument ready to be withdrawn. This has been accomplished as follows: When the support,9, can be seen by the surgeon on his monitor to be in the correct position, he takes up the tension on the two draw-shoulders,15 & 16, just sufficiently to release the lock--ing plate,18, and then gently releases the umbrella mechanisms, 10 & 14, and thus also fingers,11. The support,9, now no longer being stretched, will revert to its original length, and, more importantly, its original diameter, and thus will bear against the damaged or weak artery wall. The two bobbin halves now come together due to spring,5, or in the alternative due to magnets, 3 & 4, and thus allow fingers,11, to close right down to the outer and inner cables ,12 & 8. Thus the maximum diameter is now that of the selected bobbin, which itself is correct to easily pass through the arteries, and thus the whole instrument can be easily withdrawm through the patient's arteries.

CLAIMS.

1. A catheter type instrument comprising a bobbin, made in 2 halves, of medically-approved plastic, connected by a light tension spring, through which pass an inner and outer cable, made of metal or plastic, both operating two umbrella type op--ening and closing mechanisms, one each side of the bobbin, which operate a plurality of fingers; the operation of the inner and outer cables being by two draw-shoulders, tensioned by a spring, and lockable in any position by a multi-slotted locking plate and a pin.

2. A catheter type instrument according to Claim 1 in which the spring attached to the two bobbin halves is replaced by a small permanent magnet inserted in each bobbin half.

3. A catheter type instrument according to Claim 1 or Claim 2 in which each bobbin half has a shallow recess formed around the circumference near to the nose of each bobbin half, into which the fingers will position.

4. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the two halves of the bobbin carry within them traces of a radio-active material.

5. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the two halves of the bobbin carry within, or on the surface of, them a suitable contrast medium.

6. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the two halves of the bobbin carry within, or on the surface of, them a substance assisting in sonic scan--ning.

7. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the artery support material is marked with a radio active tracer.

8. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the artery support material carries a steadily decaying radio active tracer.

9. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the artery support material carries a permanent contrast medium.

10. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the artery support material carries a slowly decaying contrast medium.

11. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the artery support material carries a tracer which assists in ultra sonic screening.

12. A catheter type instrument according to Claim 1 or Claim 2 or Claim 3 in which the artery support material carries a tracer which assists in magnetic resonance imaging.

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